



Interagency Large Scale Networking Program

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Information Technology Research and Development

Internet2

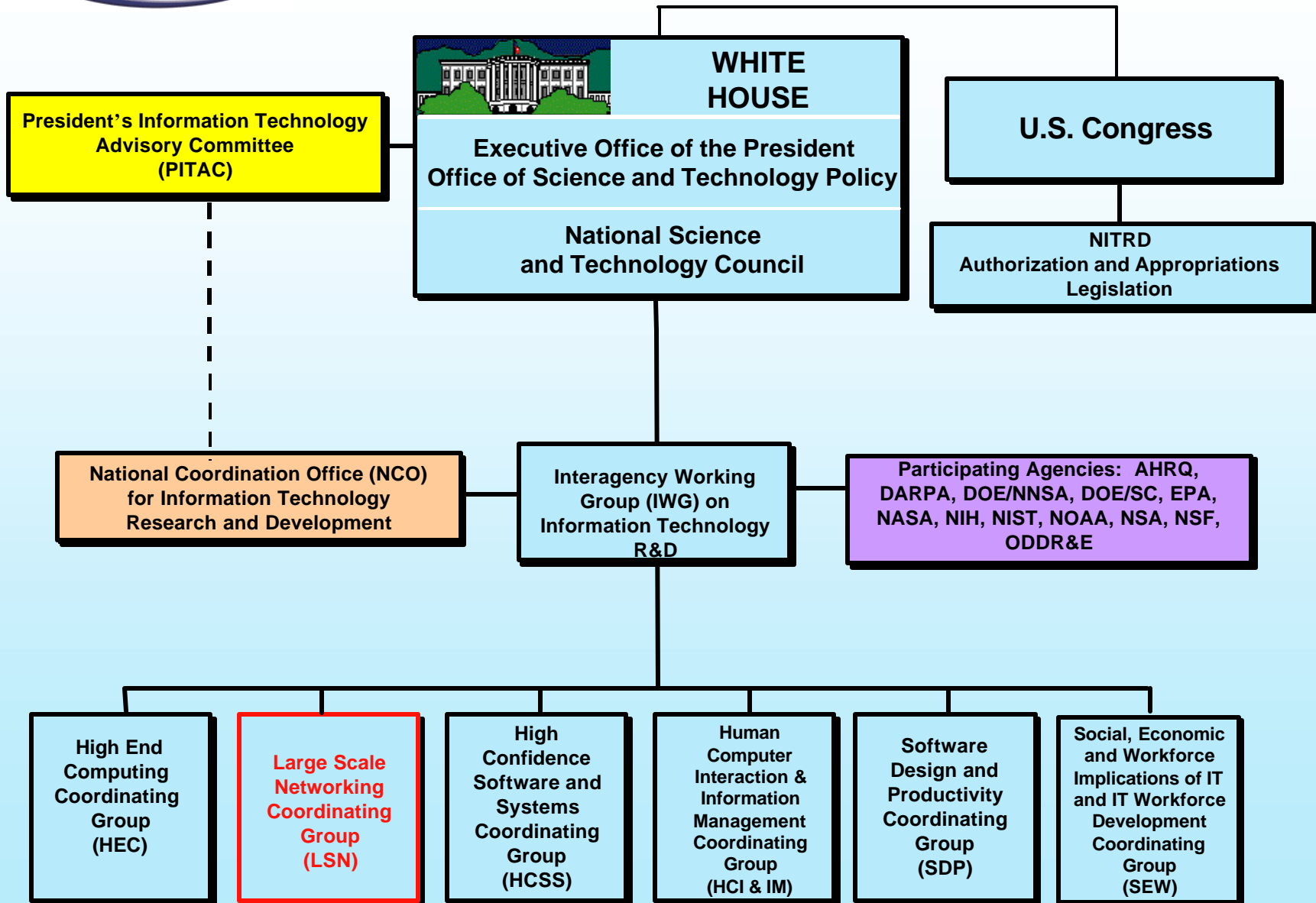
April 11, 2003



The Federal government plays a critical role in supporting fundamental research in networking and IT

- Federally-sponsored research is critical to building the technology base on which the IT industry has grown
- The Federal government funds basic research not traditionally funded by the commercial sector
 - High risk, innovative ideas whose practical benefits may take years to demonstrate
- The Networking and IT R&D program (NITRD) provides a mechanism for focused long-term interagency R&D in information technologies in a vast breadth of research and application areas
- \$2 billion multi-agency NITRD Program
 - 12 agencies and departments coordinated via a “virtual agency” coordination/management structure
 - Additional agencies participate as observers or associates
 - Coordinated by the National Coordination Office for Information Technology Research and Development
- Assessed by the President’s Information Technology Advisory Committee

NITRD Program Coordination





National Coordination Office (NCO) for Information Technology Research and Development (IT R&D)

Mission: *To formulate and promote Federal information technology research and development to meet national goals.*

- NCO Director reports to the Director of the White House Office of Science Technology Policy (OSTP) and co-chairs the Interagency Working Group for IT R&D
- Coordinates planning, budget, and assessment activities for the Federal multi-agency NITRD Program
- Supports the six technical Coordinating Groups (CGs) that report to the Interagency Working Group
 - Research planning workshops, conferences, and meetings
 - Presentations, white papers, and reports



LSN and its Teams

- **Large Scale Networking (LSN) Coordination Group**
 - Coordinates High Performance Research Network (HPRN) policy, interagency collaboration, and resource cooperation
 - Agency participants include: NIH, NSF, DARPA, DOE(SC), DOE(NNSA), ODDR&E, NIST, NASA, AHRQ, NOAA, NSA
- **Joint Engineering Team (JET)**
 - Provides engineering coordination among HPRNs for transparency, interoperability, and sharing of resources.
- **Network Research Team (NRT)**
 - Provides coordination among HPRN programs to leverage resources and promote collaboration and exchange of information
- **Middleware and Grid Infrastructure Coordination (MAGIC)**
 - Promotes HPRN middleware tools development, interoperability, research coordination, and infrastructure persistence



Federal Agency LSN Budgets

LSN Budget (dollars in millions)

Agency	FY 2002 Estimate	FY 2003 Request
NIH/NLM	\$106	\$118
NSF	103	102
DARPA	35	29
DOE/NNSA	34	15
DOE/SC	28	28
NASA	14	5
AHRQ	6	4
NIST	6	6
ODDR&E	6	6
NOAA	3	3
NSA	1	1
Totals	\$342	\$317



LSN Collaboration Research Areas

- Networking research into basic technologies, optical networking, services, and application
- Security
- Networking infrastructure for production, experimental, and research networks
- Network middleware and Grid
- Collaboration technologies
- Network monitoring and measurement
- Wireless, ad hoc, and sensor network capabilities
- Automated resource management
- Standards and specifications
- Crisis response and Critical Infrastructure Protection
- Education and training



Overview of a Few Agency Programs

- **NSF**
 - Grid Physics Network (GriPhyN)
 - Gemini: Connect 8.1 meter telescopes in Hawaii and Chile
 - AmericasPathway (AmPath)*
 - STARLight
 - High Performance Wireless Research and Education Network (HPWREN)*
- **DOE**
 - Particle Physics Data Grid (PPDG)
 - National Fusion Collaboratory (NFC)*
 - Earth System Grid (ESG)*
 - DOE Science Grid
 - Collaboratory for Multiscale Chemical Sciences (CMCS)
- **NASA**
 - Ground-Truthing Experiment*
 - NASA Information Power Grid*

** Described in the this talk*



Overview of a Few Agency Programs, Continued

- **NIST**
 - Agile Networking Infrastructures
 - Interoperability Testbed, software
- **ODDR&E**
 - Adaptive Protocols for Mobile Wireless Networks
 - Scalable Optical Networking for multilayer battlespace control
 - Mobil wireless scalable peer-to-peer networking
- **NIH**
 - Telemammography for the Next Generation Internet: National Digital Mammography Archive
 - Radiation Oncology Treatment Planning/Care Delivery Application
 - Remote, Real-time Simulation for Teaching Human Anatomy and Surgery
 - Mobile Telemedicine*

* *Described in this talk*

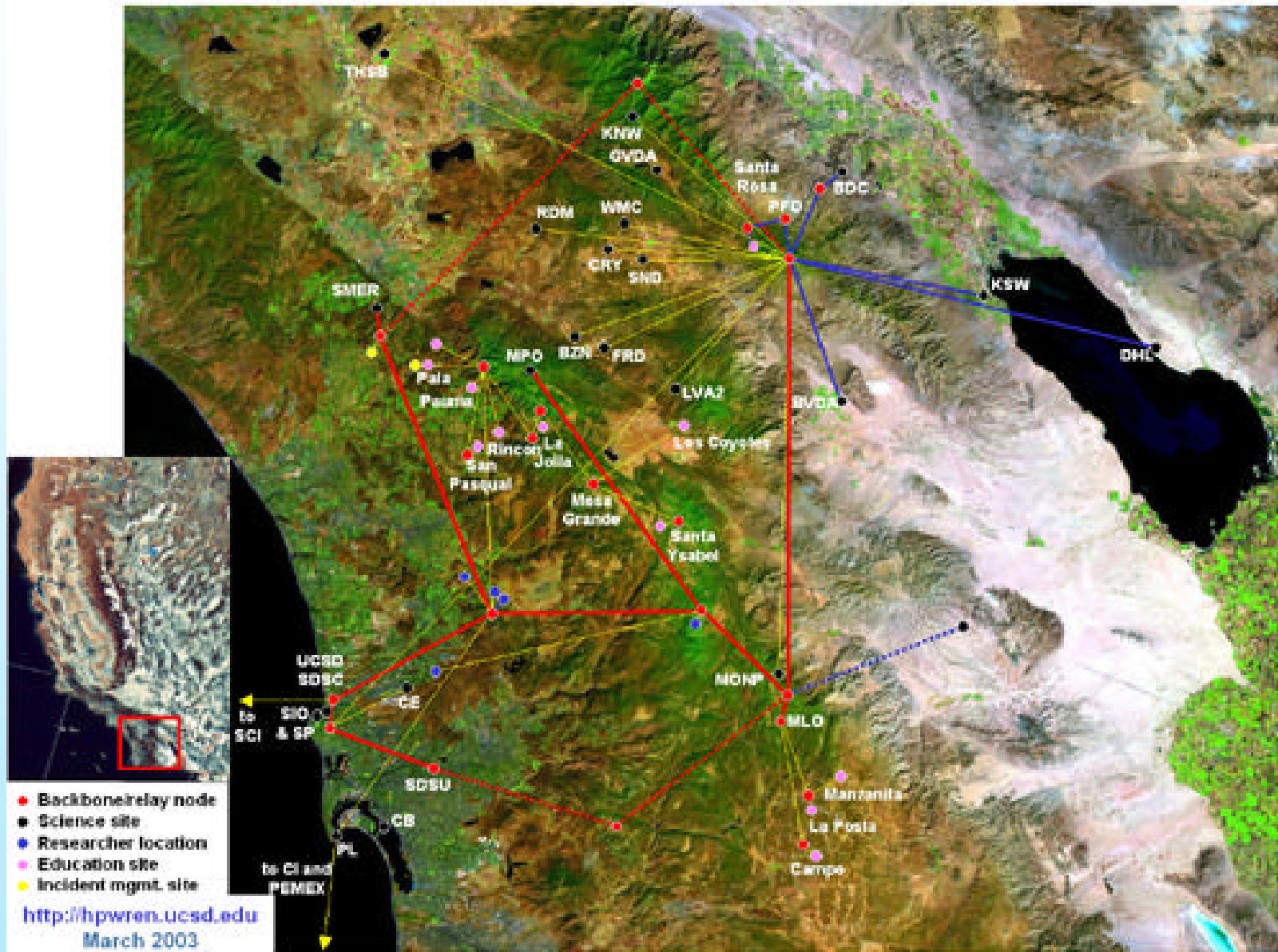


Overview of a Few Agency Programs, Concluded

- **NSA**
 - Ultra high-speed Firewalls
 - Nonlinearity and transients in optical networks
 - Optical burst switch protocols
- **NOAA**
 - Near-real-time Doppler radar data support to weather modeling
 - Crisis response weather data support

Americas Pathway (AmPath) Service Area





National Fusion Collaboratory

THE GOAL OF THE NFC IS TO ADVANCE SCIENTIFIC UNDERSTANDING & INNOVATION IN FUSION RESEARCH

Collaboratory is required to advance fusion science: geographically diverse community (37 states, 3 large experiments), leading to 1 worldwide experiment



- Diverse team

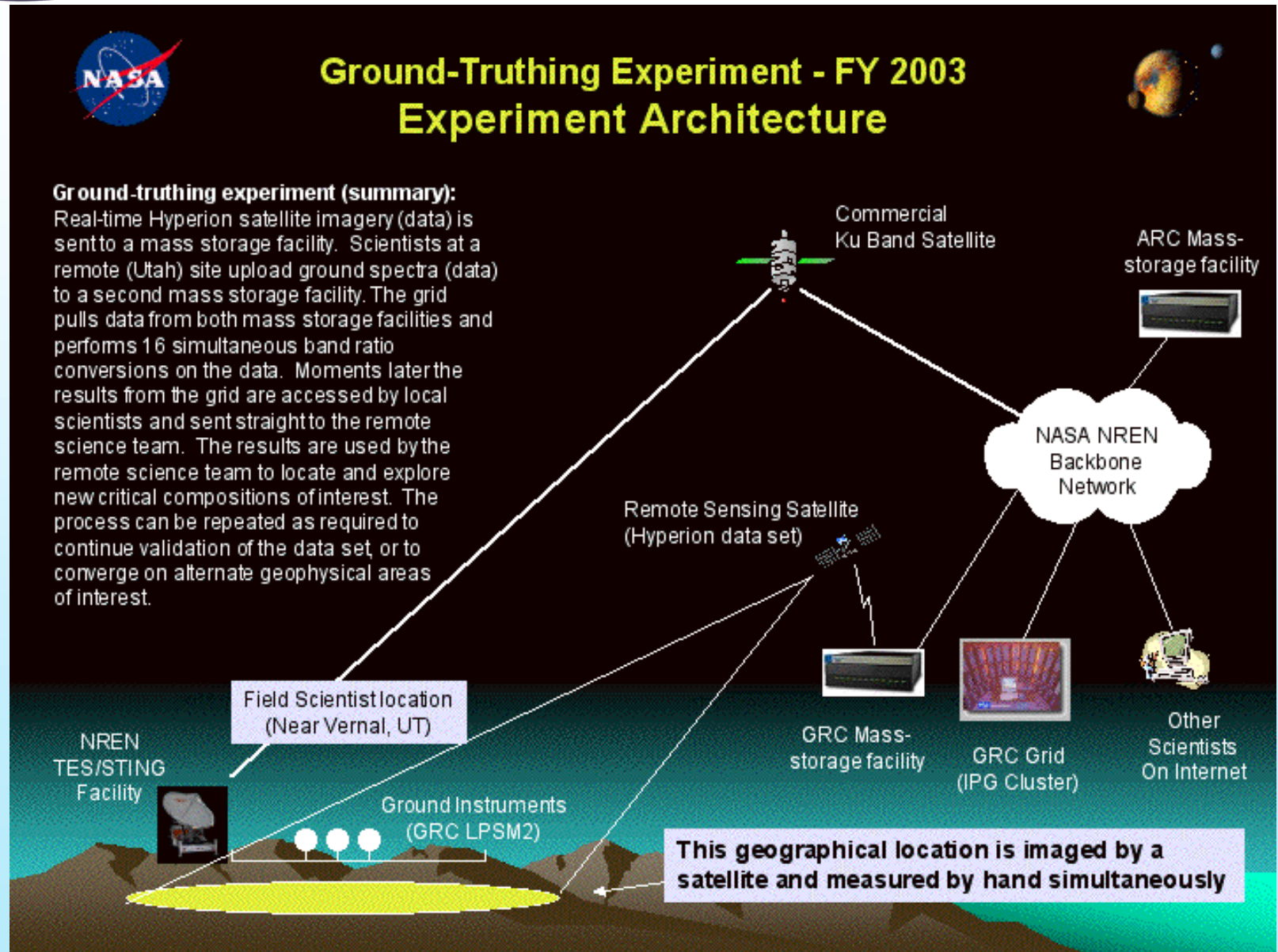
- ANL: DSL & FL
- GA: DIII-D Fusion Lab
- LBNL: Distributed Systems
- MIT: C-Mod Fusion Lab
- Princeton Computer Science
- PPPL: NSTX Fusion Lab
- U. of Utah: Scientific Comp. & Imaging

- Objective is to advance fusion science

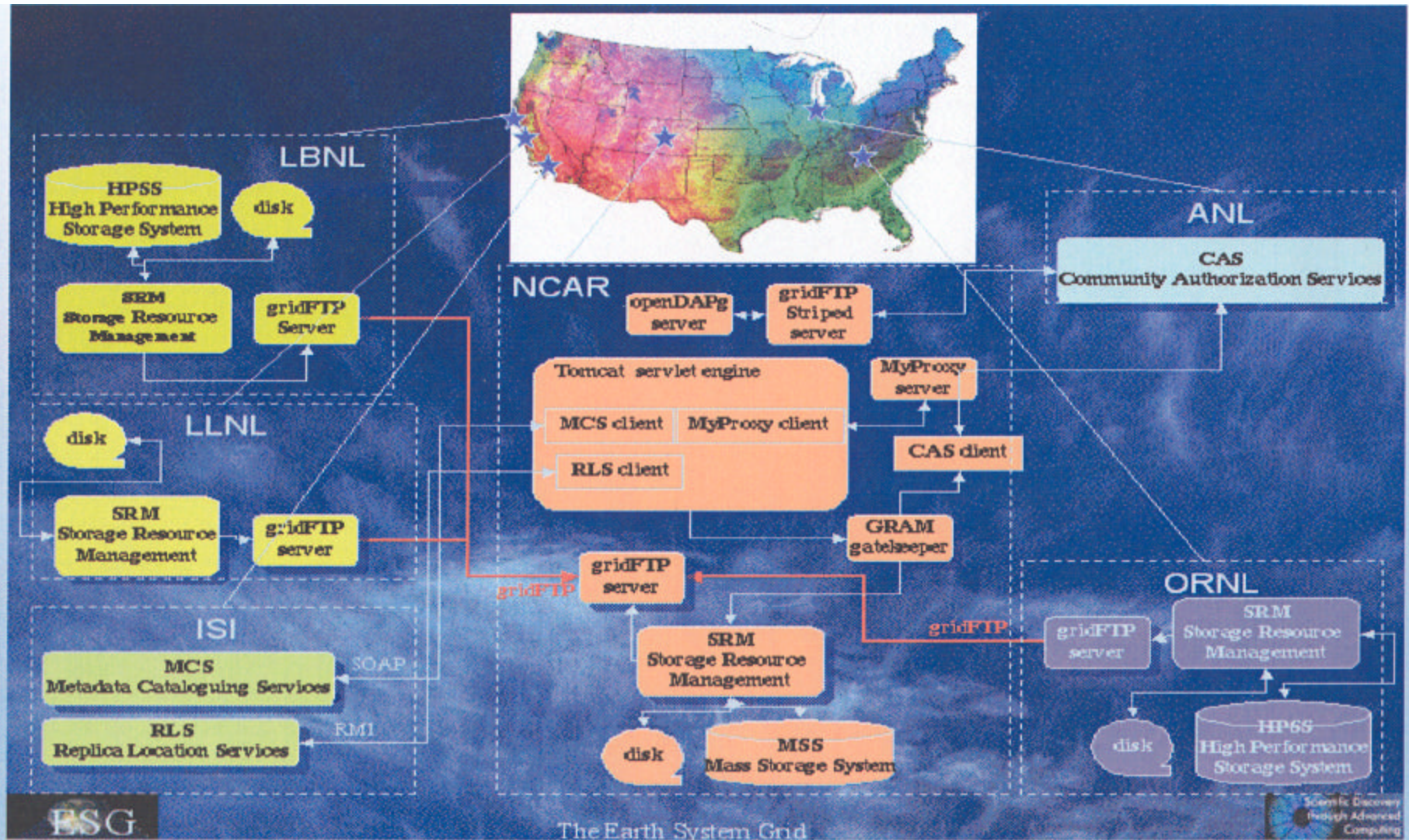
- Experimental facilities
- Integrate experiment, theory, modeling
- Create a common toolkit for services



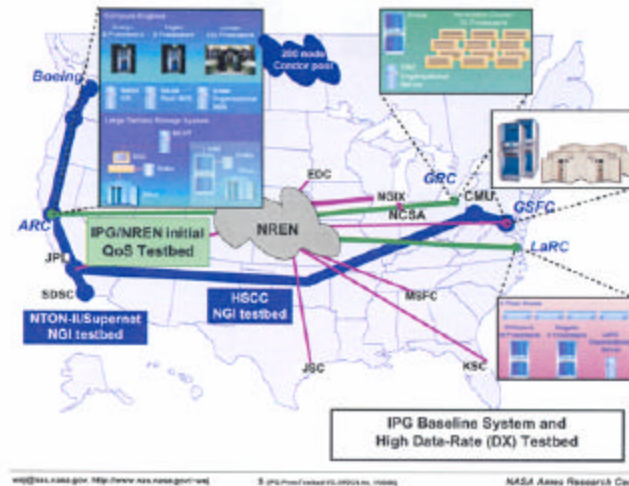
NASA Ground Truthing Experiment



The Earth System Grid



NASA Information Power Grid

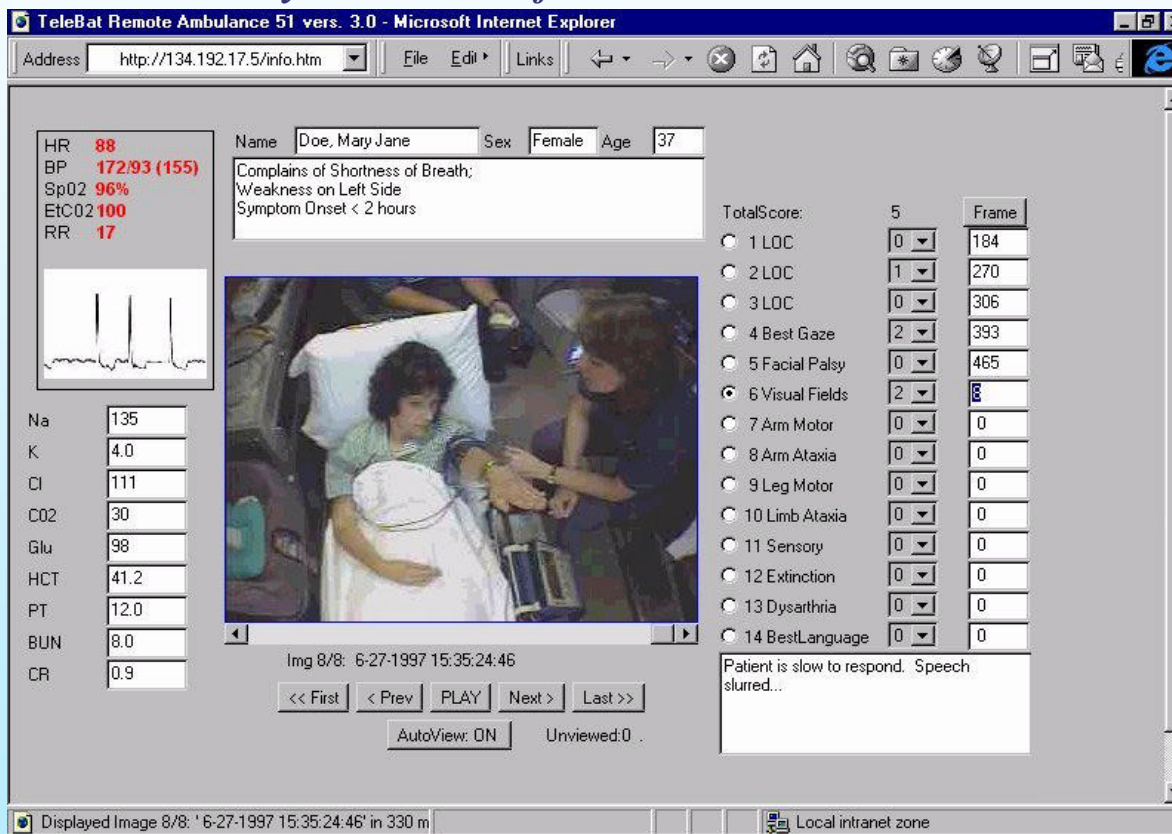


State of IPG: Baseline Operational System (cont.)

- ◆ Globus providing the Grid common services
- ◆ Programming and program execution support
 - Grid MPI (via the Globus communications library)
 - CORBA integrated with Globus
 - global job queue management
 - high throughput job manager
 - Condor [14] ("cycle stealing" computing)
- ◆ A stable and supported operational environment
- ◆ Several "benchmark" applications operating across IPG (multi-grid CFD code, parameter study)
- ◆ Multi-Grid operation (applications operating across IPG and NCSA)

- Optimizes Treatment Options in the “Golden Hour”
- Initiates the Patient Record in the Ambulance
- Enhances the Efficiency of the ER
- Improves Patient Outcomes

Intuitive Physician's Interface



TeleBat Remote Ambulance 51 vers. 3.0 - Microsoft Internet Explorer

Address: <http://134.192.17.5/info.htm>

Name: Doe, Mary Jane Sex: Female Age: 37

Complaints of Shortness of Breath;
Weakness on Left Side
Symptom Onset < 2 hours

HR: 88
BP: 172/93 (155)
SpO2: 96%
EtCO2: 100
RR: 17

Na: 135
K: 4.0
Cl: 111
CO2: 30
Glu: 98
HCT: 41.2
PT: 12.0
BUN: 8.0
CR: 0.9

TotalScore: 5

	Frame
1 LOC	184
2 LOC	270
3 LOC	306
4 Best Gaze	393
5 Facial Palsy	465
6 Visual Fields	8
7 Arm Motor	0
8 Arm Ataxia	0
9 Leg Motor	0
10 Limb Ataxia	0
11 Sensory	0
12 Extinction	0
13 Dysarthria	0
14 BestLanguage	0

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Local intranet zone

- Adjustable image compression quality (medium JPEG compression)

- Adjustable image size (320x240 24-bit images)

- About 5 kbps per phone line (4 phone lines)

Resulting in diagnostic quality slowscan video images at about 2.5 seconds per image

Northrop Grumman, Fairfax, VA
University of Maryland in Baltimore, Baltimore, MD

NORTHROP GRUMMAN



Federal Agency Network Programs Are Valuable

- They provide the basic research needed to assure long-term progress in high performance networking
- They cover a vast spectrum of research topics and applications development
- They are coordinated among the Federal agencies
- Industry, university and Internet2 cooperation with the LSN teams and project testbeds leverages Federal investments and provides technology transfer
- Public acknowledgement of funding sources helps to assure that Federal LSN programs continue
- Security, trustworthiness, and privacy issues will continue to be important



For Further Information

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Back Up



High End Computing (HEC)

- Advanced computing architectures including cluster and grids
- Mass storage
- Systems and applications software to exploit novel architectures
- State-of-the-art computing systems available to researchers

Large Scale Networking (LSN)

- Network access, reliability, security, scalability, and management technologies
- Active and intelligent networking and networking in extreme environments
- Applications such as networks of sensors, grids, and collaboratories that require high performance networking and middleware
- Testbeds

High Confidence Software and Systems (HCSS)

- Software and system availability, reliability, and safety
- Information assurance, survivability, privacy, and security
- Assured development and certification processes

Human Computer Interaction and Information Management (HCI & IM)

- Large scale data set processes, analysis, and visualization tools
- Language-based data sets and analytical tools
- Collaboratories
- Multi-modal human-system interactions
- Augmenting human performance

Software Design and Productivity (SDP)

- Software engineering of complex systems
- End-user programming including domain-specific languages and intelligent templates, and programming by example
- Component-based software development
- Software for embedded systems

Social, Economic and Workforce Implications of IT and IT

Workforce Development (SEW)

- Interdisciplinary research on the interactions and effects of IT in society
- Curriculum development, fellowships, and scholarships
- R&D in information-based learning tools, lifelong learning, and distance learning